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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/029,204	12/28/2001	Kenji Shimizu	Q63141	5380

7590 07/14/2004

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EXAMINER

BERNATZ, KEVIN M

ART UNIT PAPER NUMBER

1773

DATE MAILED: 07/14/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.		Applicant(s)	
	10/029,204		SHIMIZU ET AL.	
	Examiner		Art Unit	
	Kevin M Bernatz		1773	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-8,10,12-17 and 19-21 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-8,10,12-17 and 19-21 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input checked="" type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. <u>07122004</u> . |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date ____. | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION

Response to Amendment

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Examiner's Comments

2. Upon reconsideration and partly in view of the arguments presented by applicants in the interview of July 12, 2004, the finality of the rejection of January 14, 2004 is withdrawn and prosecution reopened. The Examiner apologizes for the inconvenience caused by the necessity of the reopening of prosecution.

An office action on the merits follows below.

Claim Rejections - 35 USC § 103

3. Claims 1, 3, 4, 8, 10, 12, 14, 16 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shukh et al. (U.S. Patent Application No. 2002/0028357 A1) in view of Akiyama et al. (U.S. Patent No. 5,815,342).

Regarding claims 1, 10, 16 and 20, Shukh et al. disclose a magnetic recording medium comprising, in sequence, on a nonmagnetic substrate (*Figure 2, element 38*), at least one soft magnetic underlayer (*element 40*), a spacer layer (i.e. applicants' "orientation control layer" - *element 42*), and a perpendicular magnetic layer (*element 44 and Paragraph 0002*), wherein said soft magnetic underlayer has a multilayer structure

(*Figure 3*) having a plurality of soft magnetic layers comprising a soft magnetic material (*elements 48 and 52 and Paragraphs 0025 - 0029*), and one or more separation layers (*element 50, 54 and 56*) interposed between said soft magnetic layers (*Figure 5*), and at least one of said soft magnetic layers comprises a material with a structure having no magnetic domain walls (*Paragraphs 0008, 0009 and 0031; wherein Shukh et al. state that the entire soft magnetic layer is a single domain and not plural domains separated by magnetic domain walls: "the soft magnetic underlayer 40 can be maintained in a generally stable single domain state"*).

Regarding the limitations "a direction of magnetization of an upper soft magnetic layer is different from a direction of magnetization of a lower soft magnetic layer" (claim 1), and "at least one set has directions of magnetization which are antiparallel" (claim 10), Shukh et al. disclose magnetization directions meeting applicants' claimed limitations (*Figure 3*).

Regarding the limitation(s) "to control the orientation of the layer immediately above", since all layers effect the grain epitaxy of the layers subsequently deposited (either by grain growth or improved adhesion, etc), the spacer layer (*element 42*) is deemed to necessarily meet the above claimed limitation.

The limitation "having an axis of easy magnetization which is oriented mainly perpendicular to the nonmagnetic substrate" is simply the definition of a perpendicular magnetic layer and is therefore met by the disclosed Shukh et al. magnetic layers.

The apparatus element “and a magnetic head for carrying out recording and reproducing of information to and from the magnetic recording medium” is disclosed by Shukh et al. (*Figures 1 and 2*).

Shukh et al. fail to disclose the limitations “the direction of the magnetization of said soft magnetic layer is along the radius of said nonmagnetic substrate and is oriented towards the periphery of the substrate or towards the center of said nonmagnetic substrate” (claim 1) and “a magnetization of said soft magnetic layer is directed along the radius of said nonmagnetic substrate towards the periphery or the center of said nonmagnetic substrate” (claims 16 and 20), though Shukh et al. does disclose that the invention is in the form of a magnetic disk (*Paragraph 0021 - “[t]he invention is particularly suitable for use with a magnetic disc storage system”*) and that the magnetization directions are in the plane of the substrate (*Figure 3*).

However, Akiyama et al. teach a perpendicular magnetic recording medium (*col. 3, lines 16 – 34*) comprising a soft magnetic undercoat comprising multiple soft magnetic layers (*Figure 15 elements 22 and 22'*) wherein the magnetization direction is controlled to be in the radial direction in order to suppress the generation of domain walls and Barkhausen noise, as well as insuring high reproducing efficiencies (*col. 4, line 55 bridging col. 5, line 12 and Figure 15*).

It would, therefore, have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Shukh et al. to use a soft magnetic layer meeting applicants' claimed magnetization direction limitations as taught

Art Unit: 1773

by Akiyama et al. since such magnetization directions suppress the generation of domain walls and Barkhausen noise, as well as insuring high reproducing efficiencies.

Regarding claims 3, 4 and 8, Shukh et al. disclose embodiments meeting applicants' claimed limitations (*Figure 3 elements 50, 54 and 56 and Paragraphs 0027 and 0028*).

Regarding claim 12, Shukh et al. fail to disclose a hard magnetic layer meeting applicants' claimed structural and property limitations. However, Akiyama et al. teach that one can add a hard bias magnetic layer under a soft magnetic layer in a perpendicular recording medium (*Figure 5, element 25 and col. 10, lines 4 – 12*) resulting in exchange coupling with the soft magnetic layer adjacent to the hard bias magnetic layer in order to suppress the occurrence of domain walls and spike Barkhausen noise (*col. 10, lines 13 – 24*), thereby meeting applicants' claimed limitations. It would therefore have been obvious to one of ordinary skill in the art at the time of the applicants' invention to modify the device of Shukh et al. to include a hard magnetic layer meeting applicants' claimed limitations as taught by Akiyama et al. in order to suppress the occurrence of domain walls and spike Barkhausen noise.

Regarding claim 14, Shukh et al. disclose structures meeting applicants' claimed limitations (*Figure 3 – element 52*).

4. Claims 2, 5 – 7, 13, 15, 17, 19 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shukh et al. in view of Akiyama et al. as applied above, and further in view of Tang et al. (U.S. Patent No. 5,750,270).

Shukh et al. and Akiyama et al. are relied upon as described above.

Regarding claims 2, 13, 17 and 21, neither of the above disclose a soft magnetic material meeting applicants' claimed limitations.

However, Tang et al. teach that the soft magnetic materials used by Shukh et al. (*Paragraphs 0026 and 0034*) are known equivalent soft magnetic materials to the claimed soft magnetic compositions (*col. 9, lines 9 – 21*).

Substitution of equivalents requires no express motivation as long as the prior art recognizes the equivalency. In the instant case, NiFe and soft magnetic materials meeting applicants' claimed limitations are equivalents in the field of soft magnetic materials capable of use in perpendicular media. *In re Fount* 213 USPQ 532 (CCPA 1982); *In re Siebentritt* 152 USPQ 618 (CCPA 1967); *Graver Tank & Mfg. Co. Inc. v. Linde Air Products Co.* 85 USPQ 328 (USSC 1950).

Regarding claims 5 - 7, Shukh et al. disclose embodiments meeting applicants' claimed limitations (*Paragraphs 0007, 0026 and 0034; wherein $Ni_{45}Fe_{55}$ is known to possess a saturation magnetization ($M_s = B_s/4\pi$) value of ~ 1.6 T and Shukh et al. explicitly teaches using materials with a $B_s > 1$ T in Paragraph 0007; see pertinent prior art cited in the Office Action mailed April 4, 2003– Inturi et al.*). The examiner further notes that the exact thickness of the soft magnetic layers (and hence, the B_{st} values) are cause effective variables in terms of the magnetization force and direction

(*Paragraph 0029*). It would, therefore, have been obvious to one having ordinary skill in the art to have determined the optimum value of a cause effective variable such as the soft magnetic layer thickness, and hence also $B_s t$ value, through routine experimentation.

Regarding claims 15 and 19, Tang et al. teach that soft magnetic layers for perpendicular media can be annealed under oxygen, thereby necessarily oxidizing the surface of the soft magnetic underlayer, in order to reduce the media noise (*col. 17, line 45 bridging col. 18, line 20*). It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Shukh et al. to oxidize the surface of the soft magnetic layer as taught by Tang et al. in order to reduce the media noise.

Response to Arguments

5. The prior rejection of claims 1 – 8, 10, 12 – 17 and 19 - 21 under 35 U.S.C § 102(e) and/or 103(a) – Shukh et al., alone or in view of various references

The pending rejection of claims 1 – 8, 10, 12 – 17 and 19 - 21 under 35 U.S.C § 103(a) – Shukh et al. in view of Akiyama et al.

Applicant's arguments have been considered but are moot in view of the new ground(s) of rejection. In so far as they apply the rejections of record, applicants argue that Shukh et al. fail to teach a magnetization of the soft magnetic layer in the radial direction. The Examiner notes that Shukh et al. teach that the magnetization directions

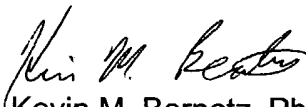
are in the plane of the substrate and that Akiyama et al., newly cited above, provides motivation to control the magnetization direction to be in the radial direction.

Conclusion

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin M Bernatz whose telephone number is (571) 272-1505. The examiner can normally be reached on M-F, 9:00 AM - 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Thibodeau can be reached on (571) 272-1516. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


Kevin M. Bernatz, PhD
Primary Examiner

July 12, 2004